Management Accounting Pillar

Managerial Level Paper

P1 – Management Accounting – Performance Evaluation

22 November 2005 – Tuesday Morning Session

Instructions to candidates

You are allowed three hours to answer this question paper.
You are allowed 20 minutes reading time **before the examination begins** during which you should read the question paper, and if you wish, make annotations on the question paper. However, you will **not** be allowed, **under any circumstances**, to open the answer book and start writing or use your calculator during this reading time.
You are strongly advised to carefully read ALL the question requirements before attempting the question concerned (that is, all parts and/or sub-questions). The requirements for the questions in Section C are contained in a dotted box.
Answer the ONE compulsory question in Section A. This is comprised of 20 sub-questions and is on pages 2 to 11.
Answer all SIX compulsory sub-questions in Section B on pages 12 and 13.
Answer ONE of the two questions in Section C on pages 14 and 15.
Maths Tables and Formulae are provided on pages 17 to 21. These pages are detachable for ease of reference.
Write your full examination number, paper number and the examination subject title in the spaces provided on the front of the examination answer book. Also write your contact ID and name in the space provided in the right hand margin and seal to close.
Tick the appropriate boxes on the front of the answer book to indicate which questions you have answered.

P1 – Performance Evaluation

TURN OVER

SECTION A – 50 MARKS

[the indicative time for answering this section is 90 minutes]

ANSWER *ALL* TWENTY SUB-QUESTIONS

Instructions for answering Section A:

The answers to the twenty sub-questions in Section A should ALL be written in your answer book.

Your answers should be clearly numbered with the sub-question number then ruled off, so that the markers know which sub-question you are answering. For multiple choice questions, you need only write the sub-question number and the letter of the answers option you have chosen. You do not need to start a new page for each sub-question.

For sub-questions **1.11, 1.12, 1.13, 1.15, 1.17 and 1.18** you should show your workings as marks are available for the method you use to answer these sub-questions.

Question One

The following data are given for sub-questions 1.1 and 1.2 below.

The following data relate to a manufacturing company. At the beginning of August there was no inventory. During August 2,000 units of product X were produced, but only 1,750 units were sold. The financial data for product X for August were as follow:

	£
Materials	40,000
Labour	12,600
Variable production overheads	9,400
Fixed production overheads	22,500
Variable selling costs	6,000
Fixed selling costs	19,300
Total costs for X for August	109,800

1.1 The value of inventory of X at 31 August using a marginal costing approach is

A £6,575

B £7,750

C £8,500

D £10,562

(2 marks)

Sub-question 1.2 is on the opposite page

1.2 The value of inventory of X at 31 August using a throughput accounting approach is

A £5,000

B £6,175

C £6,575

D £13,725

(2 marks)

1.3 A company has a budget to produce 5,000 units of product B in December. The budget for December shows that for Product B the opening inventory will be 400 units and the closing inventory will be 900 units. The monthly budgeted production cost data for product B for December is as follows:

Variable direct costs per unit	£6·00
Variable production overhead costs per unit	£3·50
Total fixed production overhead costs	£29,500

The company absorbs overheads on the basis of the budgeted number of units produced.

The budgeted profit for product B for December, using **absorption costing**, is

A £2,950 lower than it would be using **marginal costing.**

B £2,950 greater than it would be using **marginal costing.**

C £4,700 lower than it would be using **marginal costing.**

.

D £4,700 greater than it would be using **marginal costing.**

(2 marks)

Section A continues on the next page

1.4 Y has set the current budget for operating costs for its delivery vehicles, using the formula described below. Analysis has shown that the relationship between miles driven and total monthly vehicle operating costs is described in the following formula:

$$y = £800 + £0{\cdot}0002x^2$$

where

y is the total monthly operating cost of the vehicles, and
x is the number of miles driven each month

The budget for vehicle operating costs needs to be adjusted for expected inflation in vehicle operating costs of 3%, which is not included in the relationship shown above.

The delivery mileage for September was 4,100 miles, and the total actual vehicle operating costs for September were £5,000.

The total vehicle operating cost variance for September was closest to

A £713 Adverse

B £737 Adverse

C £777 Adverse

D £838 Adverse

(2 marks)

1.5 The CIMA official definition of the "variable production overhead efficiency variance" is set out below with two blank sections.

"Measures the difference between the variable overhead cost budget flexed on _____ and the variable overhead cost absorbed by _____ ."

Which combination of phrases correctly completes the definition?

	Blank 1	*Blank 2*
A	actual labour hours	budgeted output
B	standard labour hours	budgeted output
C	actual labour hours	output produced
D	standard labour hours	output produced

(2 marks)

The following data are given for sub-questions 1.6 to 1.8 below.

The following data relate to Product Z and its raw material content for September.

Budget	
Output	11,000 units of Z
Standard materials content	3 kg per unit at $4·00 per kg
Actual	
Output	10,000 units of Z
Materials purchased and used	32,000 kg at $4·80 per kg

It has now been agreed that the standard price for the raw material purchased in September should have been $5 per kg.

1.6 The materials planning price variance for September was

A $6,000 Adverse

B $30,000 Adverse

C $32,000 Adverse

D $33,000 Adverse

(2 marks)

1.7 The materials operational usage variance for September was

A $8,000 Adverse

B $9,600 Adverse

C $9,600 Favourable

D $10,000 Adverse

(2 marks)

1.8 The materials operational price variance for September was

A $6,000 Adverse

B $6,400 Favourable

C $30,000 Adverse

D $32,000 Adverse

(2 marks)

Section A continues on the next page

1.9 A company operates a just-in-time purchasing and production system and uses a backflush accounting system with a single trigger point at the point of sale. A summary of the transactions that took place in June (valued at cost) is:

	£
Conversion costs incurred	890,000
Finished goods produced	1,795,000
Finished goods sold	1,700,000
Conversion costs allocated	840,000

The two items debited to the cost of goods sold account in June would be

	£		£
A	890,000	and	95,000
B	1,700,000	and	50,000
C	1,700,000	and	95,000
D	1,795,000	and	50,000

(2 marks)

1.10 Division Y has reported annual operating profits of £40·2 million. This was after charging £6 million for the full cost of launching a new product that is expected to last three years. Division Y has a risk adjusted cost of capital of 11% and is paying interest on a substantial bank loan at 8%. The historical cost of the assets in Division Y, as shown on its balance sheet, is £100 million, and the replacement cost has been estimated at £172 million.

Ignore the effects of taxation.

The EVA® for Division Y is

A £23·28 million

B £25·28 million

C £29·20 million

D £30·44 million

(2 marks)

1.11 Z plc has found that it can estimate future sales using time-series analysis and regression techniques. The following trend equation has been derived:

$$y = 25{,}000 + 6{,}500x$$

where y is the total sales units per quarter, and
x is the time period reference number.

Z has also derived the following set of seasonal variation index values for each quarter using a multiplicative (proportional) model:

Quarter 1	70
Quarter 2	90
Quarter 3	150
Quarter 4	90

Using the above model, calculate the forecast for sales units for the third quarter of year 7, assuming that the first quarter of year 1 is time period reference number 1.

(3 marks)

1.12 Three products P, Q and R are produced together in a common process. Products P and Q are sold without further processing, but product R requires an additional process before it can be sold. No inventories are held. There is no loss of volume in the additional process for product R.

The following data apply to March.

Output	Product P	3,600 litres
	Product Q	4,100 litres
	Product R	2,800 litres
Selling prices	Product P	£4·60 per litre
	Product Q	£6·75 per litre
	Product R	£10·50 per litre
Costs incurred in the common process		£42,500
Costs incurred in the additional process for R		£19,600

Calculate the value of the common process costs that would be allocated to product R using the sales proxy method (notional sales value method).

(3 marks)

Section A continues on the next page

1.13 A company is preparing its cash budget for February using the following data. One line in the cash budget is for purchases of a raw material, J. The opening inventory of J in January is expected to be 1,075 units. The price of J is expected to be £8 per unit. The company pays for purchases at the end of the month following delivery.

One unit of J is required in the production of each unit of product 2, and J is only used in this product. Monthly sales of product 2 are expected to be:

January	4,000 units
February	5,000 units
March	6,000 units

The opening inventory of product 2 in January is expected to be 1,200 units.

The company implements the following inventory policies. At the end of each month the following amounts are held:

Raw materials: 25% of the requirement for the following month's production
Finished goods: 30% of the following month's sales

Calculate the value for purchases of J to be included in the cash budget for February.

(4 marks)

Section A continues on the opposite page

The following data are given for sub-questions 1.14 to 1.16 below

K makes many products, one of which is Product Z. K is considering adopting an activity-based costing approach for setting its budget, in place of the current practice of absorbing overheads using direct labour hours. The main budget categories and cost driver details for the whole company for October are set out below, excluding direct material costs:

Budget category	*£*	*Cost driver details*
Direct labour	128,000	8,000 direct labour hours
Set-up costs	22,000	88 set-ups each month
Quality testing costs*	34,000	40 tests each month
Other overhead costs	32,000	absorbed by direct labour hours

* A quality test is performed after every 75 units produced

The following data for Product Z is provided:

Direct materials	budgeted cost of £21·50 per unit
Direct labour	budgeted at 0·3 hours per unit
Batch size	30 units
Set-ups	2 set-ups per batch
Budgeted volume for October	150 units

1.14 Calculate the budgeted unit cost of product Z for October assuming that a direct labour-based absorption method was used for all overheads.

(2 marks)

1.15 Calculate the budgeted unit cost of product Z for October using an activity-based costing approach.

(3 marks)

1.16 Explain **in less than 50 words**, why the costs absorbed by a product using an activity-based costing approach could be higher than those absorbed if a traditional labour-based absorption system were used, and identify **two** implications of this for management.

(4 marks)

Section A continues on the next page

The following data are given for sub-questions 1.17 to 1.18 below

The KL Company provides legal and secretarial services to small businesses. KL has two divisions.

Secretarial Division
This division provides secretarial services to external clients and to the Legal Division. It charges all its clients, including the Legal Division, at a rate of £40 per hour. The marginal cost of 1 hour of secretarial services is £20.

Legal Division
The Legal Division provides legal services. One service, called L&S, involves a combination of legal and secretarial services. Each hour of L&S charged to clients involves one hour of legal services and one hour of secretarial services. The secretarial element of this service is purchased from the Secretarial Division. The likely demand for L&S at different prices is as follows:

Demand (hours)	*Price per hour (£)*
0	100
1,000	90
2,000	80
3,000	70
4,000	60
5,000	50

The marginal cost of one hour of legal services is £25.

1.17 Calculate the level of sales (hours) and total contribution of L&S that would maximise the profit from this service for the Legal Division. Assume the Legal Division pays the Secretarial Division at a rate of £40 per hour for secretarial services.

(3 marks)

1.18 Calculate the level of sales (hours) and total contribution that would maximise the profit from L&S for the KL Company as a whole.

(3 marks)

Section A continues on the opposite page

The following data are given for sub-questions 1.19 and 1.20 below

T is a large pharmaceutical manufacturing company that is implementing a 'Kaplan and Norton style' Balanced Scorecard for its research and development division. The goals and measures for the 'customer perspective' and the 'financial perspective' have been set.

1.19 For each of the two perspectives given in the question data, state an appropriate performance measure.

(2 marks)

1.20 List the other two perspectives in the Balanced Scorecard for T's research and development division, and state for each of the perspectives a relevant goal and performance measure.

(3 marks)

(Total for Section A = 50 marks)

End of Section A

Section B starts on the next page

TURN OVER

SECTION B – 30 MARKS

[the indicative time for answering this section is 54 minutes]

ANSWER *ALL* SIX SUB-QUESTIONS. EACH SUB-QUESTION IS WORTH 5 MARKS

Question Two

(a) J Limited has recently been taken over by a much larger company. For many years the budgets in J have been set by adding an inflation adjustment to the previous year's budget. The new owners of J are insisting on a 'zero-base' approach when the next budget is set, as they believe many of the indirect costs in J are much higher than in other companies under their control.

(i) Explain the main features of 'zero-based budgeting'.

(2 marks)

(ii) Discuss the problems that might arise when implementing this approach in J Limited.

(3 marks)

(b) An analysis of past output has shown that batches have a mean weight of 90 kg and that the weights conform to the normal distribution with a standard deviation of 10 kg. The company has a policy to investigate variances that fall outside the range that includes 95% of outcomes. In September one sample batch weighed 110 kg.

(i) Calculate whether the material usage variance for this batch should be investigated according to the company policy described above.

(3 marks)

(ii) Discuss two other important factors that should be taken into account when deciding whether to investigate this variance.

(2 marks)

(c) UV Limited is a catering company that provides meals for large events. It has a range of standard meals at fixed prices. It also provides meals to meet the exact requirements of a customer and prices for this service are negotiated individually with each customer.

Discuss how a 'McDonaldisation' approach to service delivery would impact on budget preparation and control within UV Limited.

(5 marks)

Section A continues on the opposite page

(d) A management consulting company had budgeted the staff requirements for a particular job as follows:

	£
40 hours of senior consultant at £100 per hour	4,000
60 hours of junior consultant at £60 per hour	3,600
Budgeted staff cost for job	7,600

The actual hours recorded were:

	£
50 hours of senior consultant at £100 per hour	5,000
55 hours of junior consultant at £60 per hour	3,300
Actual staff cost for job	8,300

The junior consultant reported that for 10 hours of the 55 hours recorded there was no work that she could do.

Calculate the following variances:

- Idle time variance
- Labour mix variance
- Labour efficiency variance

(5 marks)

(e) ST plc is a medium-sized engineering company using advanced technology. It has just implemented an integrated enterprise resource planning (ERP) system in place of an old MRP (manufacturing resource planning) system.

Discuss the changes that are likely to be seen after the implementation of the ERP system in

(i) the budget-setting process; and
(ii) the budgetary control process

(5 marks)

(f) W Limited has conducted a review of its budget-setting procedures. The review coordinator frequently heard the following comment from staff interviewed:

"It's impossible to make this system work because senior managers want budgets to be a challenging target whereas the finance department require an accurate forecast."

Discuss the issues raised in this comment, and advise the review coordinator on practical action that could be taken to alleviate the situation described.

(5 marks)

(Total for Question Two = 30 marks)

(Total for Section B = 30 marks)

Section C is on the next page

TURN OVER

SECTION C – 20 MARKS

[the indicative time for answering this section is 36 minutes]

ANSWER *ONE* OF THE TWO QUESTIONS

Question Three

(a) M Pty produces 'Biotinct' in a lengthy distillation and cooling process. Base materials are introduced at the start of this process, and further chemicals are added when it is 80% complete. Each kilogram of base materials produces 1 kilogram of Biotinct.

Data for October are:

Opening work in process:	40 kg of base materials, 25% processed	
Cost of opening work in process	Base materials	$1,550
	Processing	$720
Costs incurred in October:	Base materials (80 kg)	$3,400
	Conversion costs	$6,864
	Further chemicals	$7,200
Closing work in process:	50kg of base materials, 90% processed	
Finished output:	65 kg of Biotinct	

Under normal conditions there are no losses of base materials in this process. However, in October 5kg of partially complete Biotinct were spoiled immediately after the further chemicals had been added. The 5kg of spoiled Biotinct were not processed to finished goods stage and were sold for a total of $200.

Required:

Using the FIFO method, prepare the process account for October.

(12 marks)

(b) One of the company's management accountants overheard the Managing Director arguing as follows, "These process accounts are complicated to produce, and often conceal the true position. As I see it, the value of partly processed Biotinct is zero. In October we spent $17,464 and the output was 65 kg. So the average cost was $268·68 per kilogram, while the target cost is $170 ($40 for base materials, $70 for processing and $60 for further chemicals). These figures make me concerned about production efficiency."

Required:

Explain to the Managing Director any errors in the comment he had made, and discuss whether the data from the process account indicate that there has been production inefficiency.

(8 marks)

(Total for Question Three = 20 marks)

Question Four

Y and Z are two divisions of a large company that operate in similar markets. The divisions are treated as investment centres and every month they each prepare an operating statement to be submitted to the parent company. Operating statements for these two divisions for October are shown below:

Operating Statements for October

	Y	*Z*
	£000	*£000*
Sales revenue	900	555
Less variable costs	345	312
Contribution	555	243
Less controllable fixed costs (includes depreciation on divisional assets)	95	42
Controllable income	460	201
Less apportioned central costs	338	180
Net income before tax	122	21
Total divisional net assets	£9·76m	£1·26m

The company currently has a target return on capital of 12% per annum. However, the company believes its cost of capital is likely to rise and is considering increasing the target return on capital. At present the performance of each division and the divisional management are assessed primarily on the basis of Return on Investment (ROI).

Required:

(a) Calculate the annualised Return on Investment (ROI) for divisions Y and Z, and discuss the relative performance of the two divisions using the ROI data and other information given above.

(9 marks)

(b) Calculate the annualised Residual Income (RI) for divisions Y and Z, and explain the implications of this information for the evaluation of the divisions' performance.

(6 marks)

(c) Briefly discuss the strengths and weaknesses of ROI and RI as methods of assessing the performance of divisions. Explain two further methods of assessment of divisional performance that could be used in addition to ROI or RI.

(5 marks)

(Total for Question Four = 20 marks)

(Total for Section C = 20 marks)

End of question paper
Maths Tables and Formulae are on pages 17 to 21

TURN OVER

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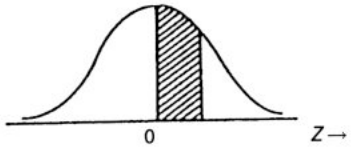
AREA UNDER THE NORMAL CURVE

This table gives the area under the normal curve between the mean and a point Z standard deviations above the mean. The corresponding area for deviations below the mean can be found by symmetry.



$Z = \frac{(x-\mu)}{\sigma}$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0159	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4430	.4441
1.6	.4452	.4463	.4474	.4485	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4762	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4865	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4980	.4980	.4981
2.9	.4981	.4982	.4983	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	**.49865**	.4987	.4987	.4988	.4988	.4989	.4989	.4989	,4990	,4990
3.1	**.49903**	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	**.49931**	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	**.49952**	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	**.49966**	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	**.49977**									

PRESENT VALUE TABLE

Present value of \$1, that is $(1+r)^{-n}$ where r = interest rate; n = number of periods until payment or receipt.

Periods	Interest rates (r)									
(n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.837	0.790	0.746	0705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180
19	0.828	0.686	0.570	0.475	0.396	0.331	0.277	0.232	0.194	0.164
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149

Periods	Interest rates (r)									
(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.079	0.065
16	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054
17	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045
18	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038
19	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031
20	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026

Cumulative present value of $1 per annum, Receivable or Payable at the end of each year for *n* years $\frac{1-(1+r)^{-n}}{r}$

Periods	Interest rates (*r*)									
(*n*)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.679	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365
20	18.046	16.351	14.878	13.590	12.462	11.470	10.594	9.818	9.129	8.514

Periods	Interest rates (*r)*									
(*n*)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	6.492	6.194	5.918	5.660	5.421	5.197	4.988	7.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

Formulae

PROBABILITY

$A \cup B$ = ***A* or *B***. $A \cap B$ = ***A* and *B*** (overlap).

$P(B \mid A)$ = probability of *B*, **given** *A*.

Rules of Addition

If *A* and *B* are mutually exclusive: $P(A \cup B) = P(A) + P(B)$

If *A* and *B* are **not** mutually exclusive: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Rules of Multiplication

If *A* and *B* are *independent*: $P(A \cap B) = P(A) * P(B)$

If *A* and *B* are **not** *independent*: $P(A \cap B) = P(A) * P(B \mid A)$

$E(X) = \sum$(probability * payoff)

Quadratic Equations

If $aX^2 + bX + c = 0$ is the general quadratic equation, the two solutions (roots) are given by:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

DESCRIPTIVE STATISTICS

Arithmetic Mean

$$\bar{x} = \frac{\sum x}{n} \qquad \bar{x} = \frac{\sum fx}{\sum f} \quad \text{(frequency distribution)}$$

Standard Deviation

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \qquad SD = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2} \quad \text{(frequency distribution)}$$

INDEX NUMBERS

Price relative = 100 * P_1/P_0 Quantity relative = 100 * Q_1/Q_0

Price: $$\frac{\sum w * \left(\frac{P_1}{P_o}\right)}{\sum w} \times 100$$

Quantity: $$\frac{\sum w * \left(\frac{Q_1}{Q_o}\right)}{\sum w} \times 100$$

TIME SERIES

Additive Model

Series = Trend + Seasonal + Random

Multiplicative Model

Series = Trend * Seasonal * Random

LINEAR REGRESSION AND CORRELATION

The linear regression equation of Y on X is given by:

$$Y = a + bX \text{ or } Y - \overline{Y} = b(X - \overline{X})$$

where

$$b = \frac{\text{Covariance (XY)}}{\text{Variance (X)}} = \frac{n\sum XY - (\sum X)(\sum yY)}{n\sum X^2 - (\sum X)^2}$$

and

$$a = \overline{Y} - b\overline{X}$$

or solve

$$\sum Y = na + b\sum X$$
$$\sum XY = a\sum X + b\sum X^2$$

Coefficient of correlation

$$r = \frac{\text{Covariance (XY)}}{\sqrt{\text{Var(X).Var(Y)}}} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{\{n\sum X^2 - (\sum X)^2\}\{n\sum Y^2 - (\sum Y)^2\}}}$$

$$R(\text{rank}) = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

FINANCIAL MATHEMATICS

Compound Interest (Values and Sums)

Future Value S, of a sum of X, invested for n periods, compounded at r% interest

$$S = X[1 + r]^n$$

Annuity

Present value of an annuity of £1 per annum receivable or payable for n years, commencing in one year, discounted at r% per annum:

$$PV = \frac{1}{r}\left[1 - \frac{1}{[1+r]^n}\right]$$

Perpetuity

Present value of £1 per annum, payable or receivable in perpetuity, commencing in one year, discounted at r% per annum:

$$PV = \frac{1}{r}$$

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Management Accounting Pillar

Managerial Level

P1 – Management Accounting – Performance Evaluation

November 2005

Tuesday Morning Session